

Health & Safety *Report*

Worker Health and Safety Branch

HS-1692

PESTICIDE ILLNESS SURVEILLANCE PROGRAM

SUMMARY REPORT

- 1991 -

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ABSTRACT

This report summarizes reports of illness or injury potentially caused by pesticide exposure received by the Worker Health and Safety Branch of the California Department of Pesticide Regulation (DPR). The most dramatic pesticide mishap of 1991 occurred on the evening of July 14, when a freight train derailed at the Cantara loop, north of the town of Dunsmuir, California. A tank car from the derailed train fell into the Sacramento River, ultimately spilling into the river all of the 19,000 gallons of metam-sodium that it carried. The pesticide reacted with water, liberating an irritant gas, methyl isothiocyanate (MITC). Of the 459 distinct individuals reported as seeking attention following the spill (36 from Shasta County, 423 from Siskiyou), four had no symptoms but were evaluated as a precaution. Information on another ten was so sketchy that they could not be classified. Nine of these ten failed to indicate what symptoms, if any, were experienced. Of the remaining 445 case reports, 357 were classified as probably related to the exposure, 78 as possibly related, nine as unlikely and one as unrelated.

Apart from the spill at Cantara, the Branch received 2,741 reports that were referred to the county agricultural commissioners for investigation. Information sufficient for classification was received for 2,486 of the 2,741, and 1,804 of them (73 percent) were classified as possibly, probably or definitely related to pesticide exposure. Of the 1,804, 1,675 (93 percent) derived from exposures that occurred while the affected person was at work (occupational exposures). Agriculture accounted for about one third of the occupational exposures.

Investigations of five deaths in 1991 revealed two related to pesticides, both people who exposed themselves to methyl bromide fumigations. The other deaths were of two aerial applicators who died in crashes and a premature infant who died of an infection unrelated to pesticides.

In 1991, as in the preceding two years, no large groups of workers sought treatment for exposure to field residue, and numbers of case reports in this category remained low. The number of possible, probable or definite cases resulting from exposure to residue in the field was 145 in 1991, 165 in 1990, and 162 in 1989. From 1982 through 1988, this category averaged 279 per year.

INTRODUCTION

Under State law ¹, the California Department of Pesticide Regulation (DPR) receives reports of illness and injury suspected of having been caused by pesticide ^a exposure, a function transferred from the California Department of Food and Agriculture as part of the comprehensive pesticide program. These cases are referred for investigation to the agricultural commissioner in the county of occurrence. The investigation reports from the counties are evaluated by DPR staff. The Worker Health and Safety Branch (WH&S) of DPR extracts data from the reports and enters them into a computerized database. This report documents and describes the reports of illness/injury received by WH&S during 1991.

The intention in maintaining these records is to document and evaluate the circumstances of exposures to pesticides that result in illness and to evaluate the effectiveness of the DPR pesticide and worker safety regulatory programs, alerting regulatory officials to possible pesticide-related problems. Information from the database feeds back into the regulatory programs and is used to develop or support proposals for the U. S. Environmental Protection Agency's Label Improvement Program and the California pesticide registration program.

The most dramatic pesticide mishap of 1991 occurred on the evening of July 14, when a freight train derailed at the Cantara loop, north of the town of Dunsmuir, California. A tank car from the derailed train fell into the Sacramento River, ultimately spilling into the river all of the 19,000 gallons of metam-sodium that it carried. The pesticide reacted with water, liberating an irritant gas, methyl isothiocyanate (MITC). Hundreds of people were affected by the spill. An emergency team from the Department of Health Services compiled a questionnaire, which was distributed at local hospitals and at a triage center. They also reminded local physicians of their responsibility to report pesticide illnesses. Accordingly, hundreds of notifications were received by the DPR. A few additional cases related to this episode were identified through workers' compensation claims.

Investigation of 1991 cases was hampered by unusually long delays in receiving case reports. Transmission of case reports from the Department of Industrial Relations (DIR) was interrupted for several months during the summer because of DIR staffing problems related to the state budget. Similarly, analysis of investigated cases at DPR was delayed by lack of support personnel to perform data entry.

^a "Pesticide" is used to describe the many substances used to control pests. Pests may be insects, fungi, weeds, rodents, nematodes, algae, viruses or bacteria--almost any living organisms that cause damage or economic loss, or transmit or produce disease. Pesticides, accordingly, include herbicides, fungicides, insecticides, rodenticides, and disinfectants, as well as insect growth regulators. In California, adjuvants also are subject to the regulations that control pesticides. Adjuvants are substances added to enhance the efficacy of a pesticide, and include emulsifiers, spreaders, and wetting and dispersing agents.

MATERIALS AND METHODS

The Reporting System

Most reports investigated as potential cases of health effects caused by pesticides reach DPR by one of two routes. Legislation enacted in 1971 and amended in 1977 requires all California physicians to report by telephone to the county health officer within 24 hours any illness or injury suspected of having been caused by pesticide exposure. The statute requires the health officer to transmit the information immediately to the county agricultural commissioner, and also to complete a Pesticide Illness Report (PIR). Copies of PIRs are sent within seven days to the Office of Environmental Health Hazard Assessment, the California Department of Industrial Relations (DIR, which also enforces the statute) and to DPR.

Additionally, WH&S staff review the Doctor's First Reports of Work Injury (DFRWIs) received by DIR. Submission of a DFRWI is required as part of the process by which physicians are compensated for treating workers injured on the job. Cases reported by DFRWIs are included for investigation if they mention pesticides as a potential cause of the illness/injury or if they mention chemicals as a cause in a situation in which pesticide use is likely.

That is, cases are sent to the counties for investigation if the terms 'pesticide', 'insecticide', 'fungicide', etc. appear, as well as if they mention a specific pesticidal product or ingredient. Mention of any 'chemical' as a possible contributor to the disease is sufficient to trigger an investigation if the worksite is one that suggests pesticide use (e.g., farm, greenhouse or nursery) or if a structural pest control operator is involved. In 1991, 2,017 of the 2,741 reports unrelated to the Cantara spill were identified through the workers' compensation system. Consequently, most of the cases investigated involved exposures that occurred at work.

WH&S sends all of the reports of cases of potential pesticide illness or injury to the county agricultural commissioner in the county of occurrence, where they are investigated by the commissioner's staff. Although established procedures require local health departments to provide the county agricultural commissioners with copies of reports of possible pesticide-related illness, WH&S also includes copies of these PIRs in its mailings in case of oversight and in order to maintain a tracking system.

In their investigations, the commissioners attempt to document the circumstances under which exposure may have occurred, possible causal factors, apparent violations of pesticide regulations and any other pertinent information. They attempt to interview both the people affected and those responsible for training and supervising the affected people. If the circumstances suggest contamination of a crop or structure, and if not too much time has elapsed since the event, the Commissioners follow a protocol for taking samples and sending them to a State laboratory for pesticide analysis.

Since the workers' compensation system is the primary source of case identification, it often is too late for meaningful sampling by the time the Commissioners learn of an episode, and the delay adds to the difficulty of locating and interviewing the people involved. However, the Com-

missioners typically take the opportunity to perform inspections of the site where the incident occurred. If these efforts uncover violations of any regulations, whether or not they contributed to the episode under investigation, the Commissioners take enforcement action where appropriate. The completed investigative reports are forwarded to WH&S for evaluation.

All reports of pesticide-related illness are investigated by the county agricultural commissioners and evaluated by DPR. A cooperative agreement among the U. S. Environmental Protection Agency, DPR, and the California Agricultural Commissioners and Sealers Association, designates incidents that meet certain standards of severity for priority investigation. Priority investigations are especially comprehensive, although the evaluation at WH&S is directed towards extracting the same information as from other cases.

A case may qualify for priority investigation by extent of environmental effects (pollution of soil, water or air, or killing of non-target species), property loss, or human health effects. Among cases qualifying on the basis of human health effects, a priority investigation is conducted if a person dies, if a person is hospitalized for 24 hours or longer and receives therapy, or if five or more symptomatic people seek medical evaluation. Summary reports of priority investigations are available to the public upon request.

Data Evaluation Procedures

The information received by WH&S is variable in focus and degree of detail. To use it as the basis for scientific and regulatory judgments, it is necessary to describe it in terms of a limited number of relevant characteristics. The objective of the evaluation is to describe each case report in terms of: (1) the adequacy of the information provided, (2) the evidence for pesticide exposure, and (3) the probability that the illness or injury reported was caused by the pesticide exposure described. Additional information also is recorded, including the medical nature of the complaint, the activity of the affected person at the time of exposure, and the availability and use of protective gear.

The determination of adequacy of information governs subsequent case classification. Staff of the Pesticide Enforcement Branch, as well as of Worker Health and Safety, train the Commissioners' staffs in the necessary components of investigation. However, when relevant information is not available, for instance when neither the affected person nor that person's employer can be located, no conclusion can be made about the case.

Collecting evidence that a person was exposed to some pesticide or pesticides almost always includes identifying the chemical(s) involved. Recording the identity of the pesticide(s) is a central feature of this program. Most often, the circumstances of the episode implicate a single pesticide. In a substantial minority of cases, however, the affected person was in contact with multiple pesticides, any of which may have contributed to the problem. This occurs partly because people who work with pesticides regularly are likely to use different pesticides at different times, and partly because several pesticides may be combined in a single application.

When only one pesticide active ingredient is identified as associated with the episode, that active ingredient is identified as the primary pesticide. When multiple pesticides are present, it may be

possible to identify one as the causal pesticide. If the affected person noticed being exposed to just one of various pesticides in use, that pesticide is entered as primary. Likewise, if the manifestations are incompatible with the other pesticides present (for instance, when cholinesterase inhibition is documented and only one of several reported pesticides is a cholinesterase inhibitor), then the implicated pesticide is entered as the primary pesticide. Otherwise, all of the pesticides identified, up to a total of ten, are recorded as associated pesticides. The term 'adjuvant' (covering such things as surfactants, emulsifiers or spreaders/stickers) may be entered among the associated pesticides, but only pesticidal active ingredients are entered as primary pesticides. Whenever possible, pesticides are identified by the common names of their active ingredients. If the compound has no generally accepted common name, a brand name or chemical name is entered.

The relationship between exposure and illness/injury is classified as follows:

- **Definite:** The signs and symptoms exhibited by the affected person are such as would be expected to result from the exposure described. Both medical evidence (such as blood cholinesterase levels or allergy tests) and physical evidence (such as leaf samples or contaminated clothing) support the conclusion that the illness/injury was the result of the pesticide exposure. Because most of the cases are identified through workers' compensation, rather than being reported promptly through local health departments, investigations typically occur weeks to months after the event. Therefore, reports by a competent observer (such as the treating physician) are accepted as evidence.
- **Probable:** There is close correspondence between the pattern of exposure and the illness/injury experienced. Medical and/or physical evidence may not be available. For example, although symptoms may be highly suggestive of cholinesterase inhibition, without results of cholinesterase testing, the case would have to be entered as probable rather than definite.
- **Possible:** There is some correspondence between the pesticide exposure described and the illness/injury experienced. The information available may be ambiguous. Headaches, nausea, and skin rashes, for example, all can be caused by many different things; and sometimes people are uncertain exactly where they were working when a problem began. Such uncertainty will cause a case to be entered as possible.
- **Unlikely:** The exposure may be uncertain; the signs and symptoms reported are not typical of the exposure suspected, but the possibility that the victim is suffering the effects of pesticide exposure cannot be discounted. Uncertain exposures may be of people far from the application site, or who only handled tightly closed packages or thoroughly cleaned containers.
- **Unrelated:** Evidence is available to demonstrate that the illness/injury was caused by factors other than exposure to pesticides. Sometimes, a product that initially was thought to be a pesticide turns out to be something else, such as a fertilizer or cleaner. Other times, the attending physician determines that the problem is infectious, not toxic.
- **Asymptomatic:** The subject of the investigation was exposed to one or more pesticides, but suffered no illness/injury in consequence. Cholinesterase depression without symptoms falls in this category. Such cases may, however, reflect lapses from good work practice; and pesticide

safety regulations require review of work practices and removal from exposure for any employee whose cholinesterase is depressed, regardless of symptomatology.

- Indirect: The illness/injury reported appears to have been caused, not by pesticide exposure, but by measures prescribed for avoiding pesticide exposure. The typical entry in this category involves the heat stress of performing vigorous work in heavy protective clothing.

The final two categories of this list were not identified prior to 1989. In previous years, such cases were designated unrelated. Tangible evidence is required to assign a relationship of definite or unrelated. Circumstantial evidence of causality or lack of causality results in classification of a case as probable or unlikely. Probable and definite cases generally are combined in discussions and tables in this report. Similarly, cases classified as unlikely, unrelated, asymptomatic and indirect often are discussed as a group.

The category of possible relationship is the most ambiguous. In practice, it generally indicates that the people involved are known to have had contact with pesticides shortly before becoming ill/injured, but evidence is not available to indicate whether or not pesticide exposure caused their illness/injury. These cases are presented separately in tables in this report. Some degree of exposure to pesticides may be assumed for cases classified as possible, probable or definite.

Explicit criteria have been established for classifying the relationship to pesticide exposure of illnesses that occur in some of the more common situations, such as exposure to cholinesterase inhibitors or dermatitis among fieldworkers. Copies of the classification criteria are available by request.

Information abstracted from the investigative reports and recorded in the database includes the type of illness/injury experienced, characterized as systemic^b, respiratory, eye and/or skin and as allergic, chronic^c and/or fatal. The intended use of the pesticide that resulted in the incident is characterized as agricultural or non-agricultural. In this context, the definition of the term 'agricultural' is intuitive rather than regulatory. Usage is considered agricultural if it was intended to contribute to production of a commodity. The date of application of the primary pesticide involved, its formulation type and toxicity category, the number of days of hospitalization required, the number of days lost from work, the date of injury, the age and sex of the injured person(s) and their activity at the time of exposure also are recorded. In 1991, the record was expanded to include indicators of the types of protective equipment used and factors that appear to have contributed to the episode. The database also includes a text description of the incident with information on individual aspects of the case.

^b All signs and symptoms other than those limited to the skin, eyes or respiratory system are classified as systemic. Tables in this report include cases with respiratory symptoms in the systemic column.

^c Chronic illnesses include both lasting effects of single exposures and ongoing reactions to ongoing exposures.

The occupational activity categories recorded in 1991 are identical to the ones used in 1989 and 1990. The category that had been designated 'coincidental' prior to 1989 is subdivided into drift exposures and those exposed via maintenance of contaminated equipment. The definition of drift exposure is broad, including any non-target exposure that occurred during an application. Additional activity categories introduced in 1989 include exposures to structural residues, exposure to residues on commodities being packed or processed, exposure to any other residues, and exposure under circumstances not covered by any defined classification.

Non-occupational exposures were subdivided into those that occurred in the process of making an application, drift exposure (defined as for the occupational activity), exposure to residue, and all others. The category of non-occupational exposure to residue was used for the first time in 1991. The category of non-occupational exposure resulting from an accident, which was used in 1989 and 1990, was deleted in 1991. Instead, an indicator of contributory factors including accidents was available for all cases, both occupational and non-occupational.

DPR recognizes that pesticide products are complex mixtures with various possible actions. It is DPR policy to consider any adverse health effect that results from pesticide exposure to be a pesticide-related illness/injury. For purposes of overall classification, the primary toxic effects of the active ingredient(s) *are not* distinguished from incidental effects such as nausea in response to odor.

Metam-sodium spill at Cantara

The exceptional nature of this episode led DPR to handle the associated cases of illness/injury separately from all others. Reports were collated by name, identifying 459 distinct individuals seeking medical evaluation in the aftermath of the spill. These reports were compared to the records maintained at the Office of Environmental Health Hazard Assessment, and found to be in agreement. In 1992, the Environmental Epidemiology and Toxicology program of the Department of Health Services released a report² stating that 705 distinct individuals were evaluated. Confidentiality considerations precluded reconciliation of these records with those received by DPR.

Since the pesticide was not in use at the time of its release, responsibility for investigation belonged to other authorities (Department of Health Services, Occupational Safety and Health Administration, Department of Transportation). DPR and the county agricultural commissioners were consulted regarding the properties of the spilled chemical, but did not perform investigations. Consequently, information about the cases reported was derived solely from physician reports (PIR and DFRWI) and the self-administered questionnaire distributed by the Department of Health Services. In all but ten cases, these were found adequate to characterize the patient's involvement. Nine of the ten cases not classified did not specify what, if any, symptoms were experienced.

In view of the massive release of metam-sodium into the environment and the known irritant properties of its breakdown product, MITC, all cases were rated 'probable' reactions to exposure unless some factor cast doubt on the relationship. Since there is no diagnostic test for metam-sodium or MITC toxicity, and the symptoms they produce can also result from other con-

ditions, it was not possible to classify any of the cases as definite.

Factors considered to indicate less than a probable relationship to pesticide exposure included: exposure more than five days after arrival of the pesticide at the location of exposure, delay of more than three days between exposure and onset of symptoms, delay of more than 31 days between exposure and medical evaluation, and diagnosis of an unrelated condition that by itself could account for the symptoms experienced. Cases were classified as 'possible' if any of these factors was present, and as 'unlikely' if multiple factors coexisted.

The cut-off points were based on the distribution of case reports as well as monitoring data and known characteristics of metam-sodium degradation and toxicology. In general, the onset of symptoms was taken to be the 'date of illness' from the physician report or 'symptom timing' from the questionnaire. When both were available, the questionnaire response was considered the more reliable. In 82 cases, the 'date of illness' from the physician report was the same as the 'date first seen'. In those cases, the 'date of illness' was not considered to indicate time of onset and that criterion was not applied.

DPR recognizes that presence of a concurrent medical condition with similar symptoms does not immunize people against toxic effects, and may make them more susceptible. Such a condition does, however, make the contribution of the toxic exposure more difficult to evaluate so that some degree of misclassification is inevitable.

Several additional criteria for evaluating relationship were considered and rejected. In particular, geographic location of exposure, type of symptoms experienced, and notations by the examining physician indicating skepticism did not generally contribute to the classification of cases.

RESULTS

DPR received reports of 3,200 people whose health may have been affected by pesticide exposure in 1991. Four hundred fifty-nine of these were involved in the metam-sodium spill at Cantara. The other 2,741 were referred to the county agricultural commissioners for investigation, at which point another 74 were found to be outside the Commissioner's jurisdiction. Preliminary information was sufficient to classify 41 of the 74. Of the 2,667 cases for which the commissioner had jurisdiction, investigations adequate to form judgments about the episodes were received for 2,445 (92 percent). Of the 2,486 interpretable cases not related to the Cantara spill, 1,804 (73 percent) were classified as possibly, probably or definitely related to pesticide exposure. Of the 1,804, 1,675 (93 percent) derived from exposures that occurred while the affected person was at work (occupational exposures). Agricultural work resulted in 555 of the occupational exposures; agricultural use of pesticides occasioned 569. These figures are presented in Table 1.

Total numbers of cases received during calendar years 1982 - 1991 are represented graphically in Figure 1.^{3 4 5 6 7 8 9 10 11} Totals for 1991 are consistent with those of previous years. Cases attributed to exposure to antimicrobials remain a major component of the case load.

Metam-sodium spill at Cantara

Of the 459 distinct individuals reported as seeking attention following the spill (36 from Shasta County, 423 from Siskiyou), four had no symptoms but were evaluated as a precaution. Information on another ten was so sketchy that they could not be classified. Nine of these ten failed to indicate what symptoms, if any, were experienced. Of the remaining 445 case reports, 357 were classified as probably related to the exposure, 78 as possibly related, nine as unlikely and one as unrelated.

Of the same 445 cases, 103 reported skin problems, 199 reported eye irritation, 287 reported respiratory trouble, and 381 reported systemic symptoms. The most frequent combinations involved systemic and respiratory symptoms (100 cases) or systemic, respiratory and eye (93 cases). Seventy-four people reported systemic symptoms only. The most common systemic symptoms reported included headache (mentioned by 273 of the 381 people with systemic symptoms), nausea (mentioned by 189) and diarrhea (mentioned by 118).

Four of the 459 people were hospitalized for a total of 15 days. Information on hospitalization was not available for one of the 459. Information on time lost from work generally was not available for the people affected by the spill. Of the 435 people probably or possibly affected by the spilled pesticide, nine were emergency response personnel exposed in the course of their duties, and 36 were exposed while working in other capacities. The other 390 people affected reported non-occupational exposures.

Case Totals - Illness

Table 1 shows the numbers of case reports received for different categories of illness, and the evaluations that were made of them with regard to the likelihood that they were caused by pesticide exposure. Of the 1,804 cases possibly, probably or definitely related to pesticide exposure, eye injury was the only symptom in 511 cases. Skin problems resulted in another 287 cases, and 37 cases included eye and skin symptoms without systemic or respiratory involvement.

Table 6 shows the breakout of involved systems for those cases presented in the other tables as 'systemic' illnesses. Systemic symptoms (such as nausea or headache) were the only sort of symptom recorded in 254 of the 969 cases reported as systemic. Systemic symptoms were accompanied by eye or skin effects, but not respiratory symptoms, in 93 cases. Respiratory symptoms were recorded in 622 cases, including 286 in which no systemic symptoms other than respiratory were reported. Injuries to the eye and/or skin (which generally may be considered irritant reactions) were recorded in 348 of the 969 cases that had systemic symptoms, including 128 of the 286 cases with no systemic symptoms apart from respiratory symptoms.

Some indication of an allergic mechanism was recognized in 116 cases. Skin reaction was the only symptom reported in 47 of these.

Case Totals - Antimicrobials

Antimicrobials are pesticides used to control microbial pests. They include sanitizers and disinfectants, but not fungicides. The antimicrobials most commonly associated with reports of illness/injury are chlorine gas (which typically is used to control bacterial contamination of water)

and sodium hypochlorite (chlorine bleach, which often is used to sanitize food processing equipment). These as well as other antimicrobial compounds have uses that do not involve their pesticidal properties. For example, sodium hypochlorite is commonly used as a cleaner, and chlorine as a reagent in various industrial processes. Accordingly, products are available that are not registered as pesticides although they contain the same ingredients as a pesticide product. Cases are entered as pesticide-related for purposes of this report if it appears that the product that caused the injury was used or was to be used with the intention of controlling pests. That is, use of sodium hypochlorite as a sanitizer results in classification as a pesticide illness, even if the product used was sold as a bleach with no pesticidal claims on its label, and consequently was not required to be registered as a pesticide. Conversely, an injury caused by a registered pesticidal product will be recorded as unrelated to pesticides if the product was being used as a laundry whitener only.

Agricultural commissioners investigated 982 cases of illness or injury suspected of having been caused by antimicrobial exposure during 1991. Seventy-nine of these proved not to be related to pesticide exposure, and 104 could not be evaluated due to lack of information. Of the remaining 799, 783 involved occupational exposures and 16 non-occupational exposures. All 16 of the non-occupational cases were evaluated as at least possibly related to the exposure, while 33 of the occupational cases were thought unlikely to be related. The 766 cases definitely, probably or possibly related to antimicrobial exposure compare to 847 so evaluated in 1990, 784 in 1989, and 746 in 1988.

Sodium hypochlorite remained the most commonly reported pesticide in 1991. It was associated with 264 definite or probable cases and 42 possible cases. In addition, 28 unidentified people were affected by a swimming pool product with sodium hypochlorite as its active ingredient. Since their individual symptoms were unavailable, it was not possible to classify these cases. Eye injury alone accounted for 150 of the definite or probable sodium hypochlorite cases and nine of the possible cases. Ninety-two systemic cases were definitely or probably attributed to sodium hypochlorite exposure, including 86 with respiratory symptoms. Exposure to chlorine gas occasioned 65 definite or probable case reports and 16 possible reports. Fifty of the definite or probable chlorine cases were systemic, all of which included respiratory symptoms. Quaternary ammonia exposures resulted in 72 definite or probable cases and nine possible cases. Forty-nine of the 72 definite or probable cases were eye injuries, and 19 involved skin only. Exposure to combinations of antimicrobials resulted in 97 definite or probable cases and 22 possible cases.

Antimicrobials constitute a substantial fraction of the pesticide sold in California. In 1991, the total of just over half a billion pounds of pesticide sold included more than 102 million pounds of 'disinfectant', more than 11 million pounds of 'bactericide', and more than 188 million pounds of 'algacide' as well as over 8 million pounds of 'antimicrobial.' These categories included more than 176 million pounds of pesticidal chlorine and over 66 million pounds of pesticidal sodium hypochlorite. Figures are not available for the amounts of these products sold for non-pesticidal uses.

Case Totals - Activity

Numbers of case reports in each activity category are presented in Table 2. As in 1990, the largest categories tended to be those associated with use of antimicrobials: mixer/loader for hand ap-

plication (149 antimicrobial cases of a total of 158); hand applicator (51 of 199); applicator by means other than aerial, ground or hand (292 of 305); drift exposure (96 of 316). Other activity classes with more than one hundred possible, probable or definite cases were exposure to field residue (145 cases) and exposure to residue of structural applications (142 cases). The major non-occupational exposure situations were exposure to residue (66 cases) and drift exposure (47 cases).

As in 1989 and 1990, drift exposure was defined to include all people not engaged in applying pesticide who were exposed incidentally to an application. Agricultural applications resulted in 178 of the 316 occupational drift exposures and 22 of the 47 non-occupational drift exposures. Two large episodes, one involving 41 strawberry harvesters and one involving 64 broccoli harvesters, accounted for the majority of the agricultural drift cases. Drift was confirmed by laboratory detection of the pesticide in the episode involving the strawberry harvesters. In the other episode, the suspect pesticides were not detected on foliage samples taken the day of the event. Residue of a pesticide applied to the broccoli several days earlier was detected. Nevertheless, the fact of an application taking place a quarter-mile upwind of the crews (wind velocity was 4 - 5 mph) was considered sufficient to enter the cases as possibly related to drift exposure. Antimicrobials were implicated in 16 of the non-occupational drift cases and 96 of the occupational drift cases, including 8 exposed to drift from agricultural use of antimicrobials in preparing harvested crops for market.

The category of hand applicator applies only to people using hand-held equipment, such as spray wands or pressurized cans. Applications such as wiping or dipping are classified as 'other' applications. Mixing/loading for hand application does, however, include preparation of pesticide dilutions for purposes such as wiping or dipping.

Health effects attributed to exposure to field residue during 1991 remained at the relatively low level observed during 1989 and 1990. In 1991, 145 possible, probable or definite cases were identified as involving exposure to field residue. The comparable figures were 165 in 1990 and 161 in 1989. From 1982 through 1988, numbers of cases associated with field residue exposure averaged 279 per year. The low numbers observed since 1989 reflect an absence of large group episodes. In 1991, two field residue episodes involved five people each, three involved four people each, two involved three people each, and seven each involved two people. All the other cases were isolated events.

Exposures that conformed to none of the defined categories were classified as "other." This category included 36 exposures at work and 390 non-occupational exposures to the metam-sodium spilled into the Sacramento river when a train derailed at the Cantara loop. Apart from the Cantara spill, there were 98 cases in the "other" category of occupational exposure, of which eight involved equipment failures and 43 involved other sorts of accidents. These typically involved splashes or spills resulting from mishaps such as bumping or dropping pesticide containers, dropping something else into a pesticide container, or inadvertently triggering pesticide release. Antimicrobials were the pesticides implicated in 49 of the 98 "other" occupational cases, including 30 of the 43 in which accidents were instrumental. Four people were sprayed deliberately with animal repellent, although this is an illegal use under the label. Three suspected thieves sprayed the people who confronted them; in the fourth case, the sprayer was a motorist

who accused another driver of rude behavior and sprayed him. One person was exposed accidentally to animal repellent that he was carrying himself.

Only ten non-occupational exposures could not be classified in one of the defined categories. These included three people who entered structures under fumigation (one survived) and two voluntary ingestions of pesticides (both survived).

Three cases were caused, not by pesticide exposure, but by protective measures prescribed to avoid pesticide exposure. One person was demonstrated to be allergic to the rubber gloves required for handling the pesticide. Two developed problems related to the respirators they were required to wear: One of these developed an earache, while the other developed transient swelling and numbness of the area under the respirator, which he had strapped on very tightly.

Hospitalization and Disability

Tables 3A and 3B present, by activity category, the cost of pesticide-associated illness/injury in hospitalization and lost work time. Of the 1,107 definite or probable cases, 15 reported a total of 40 days' hospitalization. Five cases lacked information on whether or not hospitalization was required. Two hundred fifty-eight of the people definitely or probably affected by pesticides missed a total of 1025 days of work, while four other people were prevented from working for an indefinite period and information about disability was unavailable for 39. The 697 cases possibly related to pesticide exposure included three hospitalized for 13 days and 165 who missed 800 days of work, as well as one without information on hospitalization and 51 without information on disability. Antimicrobial exposure was implicated in 644 definite or probable cases, of which five were hospitalized for a total of six days and 114 missed a total of 337 days of work. Among the 122 cases possibly related to antimicrobial exposure, none was hospitalized, but 24 missed a total of 161 work days.

Overall, 1.4 percent of people definitely or probably affected by pesticides were hospitalized, while 0.43 percent of the people possibly affected were. Comparable figures for 1990 were 2.4 percent and 0.55 percent. The fraction of affected people who missed work beyond the day of the event was between 23 and 24 percent, both for people possibly affected and for those probably or definitely affected. In 1990, 25 percent of probably or definitely affected people and 22 percent of those possibly affected missed work.

Two people judged possibly affected by pesticide missed extraordinarily long periods from work in 1991: A groundskeeper at a golf course complained of smelling an unusual odor while removing sod killed by methyl bromide. A few days later, he was hospitalized for 6 days with pneumonia and missed 168 days of work due to continuing chest pain. A pregnant woman whose work area was sprayed with pyrethrins may have developed weakness, sweating and nausea in response to a brief exposure. However, her fainting 12 days later, followed by four days' hospitalization and 55 days' disability, does not appear upon investigation to be related to pesticide exposure.

Exposure to antimicrobials contributed six days' hospitalization among five people definitely or probably affected, 337 days of lost work among 114 people definitely or probably affected, and

161 days of lost work among 24 people possibly affected. The 161 days of work lost by people possibly affected by antimicrobial exposure included 30 days (six weeks) missed by a chemical technician with a history of asthma who walked past cooling towers recently treated with calcium hypochlorite, 21 days missed by a swimming instructor who had to find other work because of the rash she developed after exposure to pool chlorine, and 21 days missed by an untrained maintenance man who handled wet pool chlorine tablets without protective equipment.

Case Totals - Active Ingredients

Table 4 lists the numbers of cases associated with each active ingredient. The majority of the cases possibly, probably or definitely related to pesticide exposure (1,191 of 1,804) involved a single, identifiable active ingredient. Cases in which more than one active ingredient was involved are summarized by functional categories in Table 4. Presence of adjuvants (such as surfactants, emulsifiers or spreader/stickers) or synergists was not considered in assigning mixtures to functional categories. Use of a compound intended to modify the behavior of insects or to regulate the growth of insects or plants resulted in assigning the mixture to the "miscellaneous" category, along with combinations including molluscicides and a few unusual combinations of common types of pesticides. Expanded tables listing each combination separately and identifying the activities of the people affected will be produced as a supplement to this report. Most of the numbers in Table 4 are so small that they are likely to show substantial random variation from year to year. It is also important in interpreting these figures to consider the numbers of people exposed to the different compounds, the circumstances in which they are exposed, and the amounts used.

Case Totals - County

The numbers of cases reported and the results of evaluation of those cases are listed in Table 5. No cases were reported from Alpine, Inyo, Modoc, Mono, or Sierra County.

Besides the total numbers of cases in each likelihood category, Table 5 presents the numbers of those for which agricultural or non-agricultural pesticide use was implicated and a general classification of the exposure situation. This classification of exposure as relating to concentrate, to pesticide in use, or to residue is based on the activity of the people affected, and is applied to occupational exposures only.

Exposures in response to emergencies (such as fires or spills), exposures in the course of manufacturing or formulation, and exposures to packaged products in the channels of trade all are considered to represent exposures to concentrate. Exposures of mixers, loaders, applicators, flaggers, people performing fumigations, and people exposed to drift are use-related exposures. Exposure to residue includes field residue, residue from structural applications, residues on commodities being packed or processed and any other residues, as well as exposure of people maintaining contaminated equipment. Occupational activities classified as "other" and all non-occupational exposures are excluded from this classification system.

All of the cases with sufficient information to evaluate relationship to pesticides were classified as either agricultural or non-agricultural. Agricultural cases were those in which the pesticide to which the affected person was exposed was intended to contribute to production of an agricultural commodity. The contribution occasionally was indirect, as in the case of a worker exposed while applying a herbicide to weeds around a farm shop building or one cleaning chicks' drinking cups. Making pesticide deliveries to farms, however, was classified as non-agricultural, as was working for the county agricultural commissioner.

Fatalities

Investigations of five deaths that occurred in 1991 revealed two related to pesticide exposure:

A neighborhood resident was found dead when tenting was removed from a small apartment building fumigated with methyl bromide. The building was placarded and secured, and the victim did not appear to have entered it. Interviews with neighbors suggested that the victim was alcoholic and had been drinking heavily on the day of the fumigation. It was hypothesized that he may have mistaken the tarped building for his home, a few doors away. The death was considered accidental.

The owner of a house being fumigated with methyl bromide was found dead in a back bedroom of the house by the fumigation crew removing the tent. A door was open, although its safety lock was intact. An abnormally high level of bromide was found in the victim's blood; toxicology screening was negative otherwise. The death was considered a suicide.

The other three deaths were found not to be related to pesticides. Two aerial applicators were killed, one in a mid-air collision that injured another pilot non-fatally, and one when his helicopter crashed on take-off. A premature infant died of an infection that was apparent prior to returning to her fumigated home.

Chronic Illness

The possibility of chronic illness was recognized in 31 cases reported during 1991. Two of them could not be evaluated due to lack of information, ten were found not to have been caused by pesticides, and seven were unlikely to have been caused by pesticides. One mechanic demonstrated cholinesterase inhibition after years of working on application equipment and living in the upper floors of a converted water tower, the bottom floor of which was used for pesticide storage. This was the only one of the chronic cases that could be demonstrated definitely related to pesticide exposure. A fumigator developed an apparent case of chemical hepatitis after five years of work, during which he sometimes neglected use of required respiratory protection. This case was evaluated as probably related to exposure. The remainder of the chronic cases were only possibly related to the reported exposures.

Five people developed skin irritations, possibly in response to continued contact with antimicrobials. A couple who had lived and worked for twelve years at a refuse site developed headaches, nervousness and insomnia after an unknown period of exposure to well water contaminated with DBCP and tetrachloroethylene. Two men who, in separate situations, had applied

various pesticides developed health problems that continued after they lost their jobs. One of the people exposed to metam-sodium subsequent to the spill at Cantara developed a rash and eye irritation in the immediate aftermath; five months later, she complained of headaches, fatigue and depression, and her physician reported these as possible late effects of exposure. This last case is on record as probably related to pesticide exposure, but that relationship refers to the rash and eye irritation experienced acutely.

Age and Gender Distribution

Table 8 presents age and sex distributions of the people involved in the incidents summarized in this report. As in 1990, the majority of them were in their 20's and 30's, and the average age of affected women was somewhat higher than of affected men. All age groups were involved more or less equally in the metam-sodium spill at Cantara. In agricultural settings, the ratio of males to females was between 2:1 and 3:1. In other settings, the numbers were roughly equivalent, though somewhat more males than females were affected. This was true of antimicrobials as well as of other pesticides.

Contributory Factors

In 1991, DPR began recording aspects of pesticide exposure situations that appeared to have contributed to the development of health problems. Staff members evaluating and abstracting case information were asked to indicate whether the affected person was unusually susceptible, whether the exposure was deliberate, whether equipment failure or some other type of accident had resulted in the exposure, whether the people affected had come into direct contact with the pesticide, and whether they had smelled the pesticide. Among violations of safe pesticide use practices, evaluators were asked to distinguish among reentry during a restricted period, failure to use required protective equipment, and any other form of misuse.

This information may not yet be highly uniform or reliable. In reviewing cases classified as "other" occupational exposures, 28 were initially found to have been identified as resulting from accidents, but another 15 included statements that indicated an accident was involved. In five of the 15, the evaluator who had not selected the "accident" indicator had used the word "accident" in describing the case.

Subject to the limitations of newly introduced efforts, the following appeared to be the major contributory factors: Of the 1,804 people definitely, probably or possibly affected by pesticide exposure other than metam-sodium spilled at Cantara, 475 had been in direct contact with the pesticide and 432 reported smelling it. Of the people who reported odor, only four had had direct contact. Violations of required procedures contributed to 846 of the 1804 cases, including 172 of 363 drift exposures. Among the 200 exposures to drift from agricultural applications, the applicator was thought to be at fault in 142. Failure to use required safety equipment contributed to 381 of the 1804 cases, including 205 in which additional violations were identified. Equipment failures contributed to 148 cases, including 58 of the 475 people who had direct contact with the pesticide. Violations were recorded in 53 of the 148 cases with equipment failures.

Of the 1,804 affected people, 596 were exposed while making or preparing to make non-agricultural applications. Of those 596, 137 were not using required safety equipment, 89 were affected by other violations, and 174 were involved in violative applications as well as failing to use the equipment required. The typical situation in this category involved use of a sanitizer, often in a food service or health care setting, without wearing goggles or a face shield. People making or preparing for agricultural applications were affected in 182 cases, including 28 who did not use required safety equipment, 37 affected by other violations, and 17 affected by violations while not using required equipment.

Fifteen of the exposures were deliberate. Ninety-two of the people affected, none of whom was exposed deliberately, were recognized as being particularly susceptible. Thirty-six of the 92 described themselves as sensitive, 19 of them to chemicals generally, seven to pesticides or insecticides as a class, five to the specific agent to which they were exposed, and five said they had sensitive skin. Twenty-five were characterized as susceptible on the basis of repeated episodes of reaction. Twenty had chronic conditions, including 14 cases of asthma, and five had acute infections. Three people had medically documented allergies, one to gluteraldehyde, one to strawberries, and one to sulfur. Two women were affected during pregnancy; both were office workers whose work areas were treated with insecticides. One agricultural worker was exposed to drift while on alternative assignment waiting for his asymptotically depressed cholinesterase level to recover.

The 435 people affected by the metam-sodium spill at Cantara included 31 recognized as susceptible. Two had acute infections at the time they were exposed, and 21 had chronic conditions, including 12 asthmatics and five with other chronic respiratory conditions. Six pregnant women were affected, while one person was classified as susceptible because he was a heavy smoker and another was so designated only because of a positive response to the question of recent alcohol intake on the self-administered questionnaire.

Priority Investigations

Agricultural commissioners performed priority investigations of 68 episodes in 1991, including the metam-sodium spill at Cantara. Three of these episodes (one in which eight office workers detected odor from a leaking pesticide container, one in which an incompletely trained mixer/loader/applicator was hospitalized for three days, and one in which six people complained of the odor of an inappropriate pesticide application at an institution) occurred in 1990, but were recognized as meeting priority criteria in 1991. Four of the episodes assigned priority investigations did not actually meet priority criteria: Two involved four people each, one involved a crash of an aerial applicator that resulted in no injury, and in one episode dozens of people left a worksite that had been treated with pesticide, but only one of them consulted a physician.

All five of the deaths investigated in 1991 were assigned priority numbers. Two of them resulted from exposure to methyl bromide in use as a structural fumigant, although both of the applications involved were performed properly. In particular, both buildings were locked and placarded; and appropriate amounts of chloropicrin were used as a warning agent. The death of a premature infant was determined at autopsy to have been caused by massive infection, and not by any potential residue in her recently-fumigated home. The other two fatalities investigated were of ae-

rial applicators who crashed, one immediately upon take-off and another in mid-air, seriously injuring the other pilot. Four additional non-fatal crashes of aerial applicators were investigated. Pesticide exposure was not found to be a factor in any of the crashes.

One fish kill, one bird kill, and one kill involving both birds and fish were investigated. No pesticide applications in the vicinity of the fish kill had been reported during the preceding three months, and no pesticide was detected in the fish. In the bird kill, analysis of the dead birds revealed carbofuran, although no source for it was determined. The kill that involved both birds and fish resulted when a faulty valve allowed an application of carbofuran in a vineyard to spill into a creek. The settlement between the district attorney and the grower included payment of \$100,000 in remediation costs and \$50,000 in court costs, as well as purchasing an island for use as a wildlife refuge.

Six of the priority investigations concerned evacuations. Two of the evacuations involved fires, one in a wood treatment facility, where a tank containing ammonia, zinc and copper arsenate exploded; and one in a pesticide manufacturing plant, where liquid sulfur ignited. A third evacuation occurred when smoke was observed coming from a building under fumigation; this resulted from failure to extinguish the pilot light of the water heater. In an oxygen-deficient atmosphere, the pilot light began generating visible smoke. Thirty homes were evacuated when the odor of a metam-sodium application was mistaken for leaking natural gas. No people were known to have sought treatment in any of these four episodes. Three people consulted doctors and about 3,000 were evacuated when workers noticed an odor associated with a trailer being unloaded. The trailer previously had been used to deliver pesticide, and although it had been cleaned, the odor remained. After it was cleaned again, and a contaminated pallet was removed, the problem resolved. One other evacuation occurred in response to the odor generated when a homeowner treated his fence with an unregistered pesticide. The fire department (the first agency contacted by concerned neighbors) referred this case to the district attorney, and the homeowner was assessed a fine of \$5,000. The fine was suspended in consideration of his payment of investigation and remediation costs in excess of \$10,000.

Twenty-five priority investigations were assigned because five or more people were involved. Apart from the metam-sodium spill at Cantara, which is discussed elsewhere, these involved 42 cases definitely related to pesticide exposure, 138 probably related, 112 possibly related, three unlikely to be related, nine asymptomatic people exposed to pesticides in group episodes, and 41 that could not be classified due to lack of information. Two group episodes involving a total of 24 people proved unrelated to pesticides.

Twenty-two priority investigations were assigned on the basis of hospitalization. Twenty of these involved a single hospitalized person each, including four unrelated to pesticide exposure and one unlikely to be related. Three of the four unrelated hospitalizations were of pilots who crashed. Three hotel employees were exposed to chlorine gas, and one was hospitalized. Two young siblings were hospitalized after parathion was used to disinfest their home. Another young child was hospitalized in an unrelated episode of domestic parathion use. All three children received prompt and vigorous treatment, and made apparently full recoveries.

DISCUSSION

Reporting

This registry is based on mandatory physician reporting. State laws require physicians to report all pesticide illnesses to the local health department and all occupational illnesses to the Department of Industrial Relations. Illnesses among people who, for whatever reason, do not consult a physician are unlikely to be identified. Additionally, although physicians have a responsibility to report any patient whose problems may have been caused by pesticide exposure, in practice most cases investigated are occupational exposures located primarily through the workers' compensation system. Although this should be sufficient to identify any serious problems with pesticide use, it limits the conclusions that can be drawn about the total number of people affected. In addition, the time lag inevitable in collecting reports from the workers' compensation system compromises the completeness of the subsequent investigation. This problem was particularly acute in 1991, when budgeting concerns resulted in interruptions in access to workers' compensation cases. Eventually all cases were reviewed, but many were months old before they were sent to the counties.

Classification

Classification of cases as definite, probable, possible, unlikely or unrelated expresses the level of certainty that the illness described resulted, at least in part, from pesticide exposure. In interpreting the figures in this report, it is important to remember that some sorts of exposures and illnesses are easier to ascertain than others. Eye injuries in particular are much easier to attribute to specific causes than other types of symptoms are. Most common systemic symptoms are compatible with numerous causes, though certain manifestations are highly suggestive of cholinesterase inhibition, and respiratory symptoms are characteristic of inhalation exposures. Table 9 shows the distribution of relationships assigned by category of pesticide and type of symptom.

Use of the scaled relationship classification (definite, probable, possible, etc.) recognizes the uncertainties that typically remain after even the most diligent investigation, and the consequent inevitability of some degree of misclassification. For most variables, misclassification will obscure relationships that exist--for instance, all pesticides and all exposure scenarios will appear to carry more nearly the same risk than if classification were error-free. Consideration of the cases for which uncertainty is least (those classified definite or probable) should reduce misclassification bias and clarify relationships.

Evaluation of the contribution of violations of pesticide use regulations may be particularly susceptible to distortion. Informants, both employers and employees, may be motivated to exaggerate compliance and downplay the role of violations. Investigators, who are also enforcement agents, may over-emphasize detection of violations. The contributions of these opposing tendencies cannot presently be evaluated.

Analysis

There are no major discontinuities between the figures in this report and those of preceding years. In particular, cases attributed to field residue have continued at the reduced level observed beginning in 1989. Standards of case identification and evaluation have been consistent since 1987. Only 33 field residue cases were omitted from analysis due to lack of information, fewer than were omitted in preceding years. Consistently low numbers of reports of exposure to field residue inspire hope that stringent regulation and careful compliance are achieving their goal of pesticide safety.

Hospitalizations of three young children exposed to parathion by well-meaning relatives trying to disinfest their dwellings illustrate the severe danger in making personal use of pesticides intended for production agriculture. Such compounds allow little margin for error. Without the prescribed equipment and procedures, these agricultural products cannot be used safely.

Acknowledgements

This report is an attempt to summarize information collected through the year-round efforts of dozens of workers. Space prevents explicit recognition of the enforcement staff and county investigators whose work provides the basis of this report. Special thanks are due to Don Richmond, without whose careful oversight the system could not function. Other Worker Health and Safety staff members who made essential contributions to this work include:

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FIGURE 1: ILLNESSES/INJURIES RE

TOTAL REPORTS 1982 - 1991

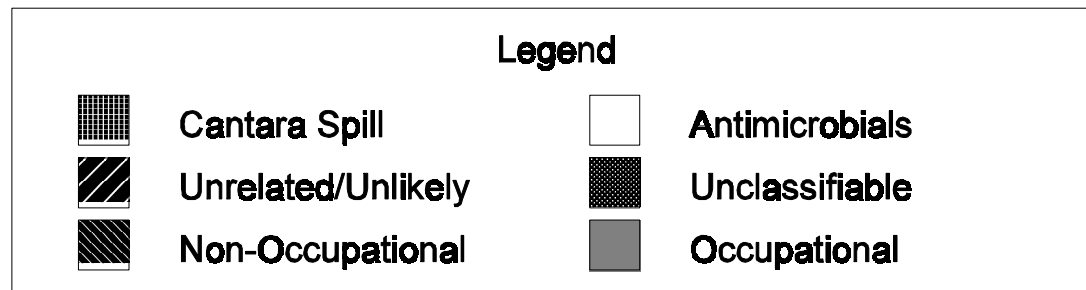
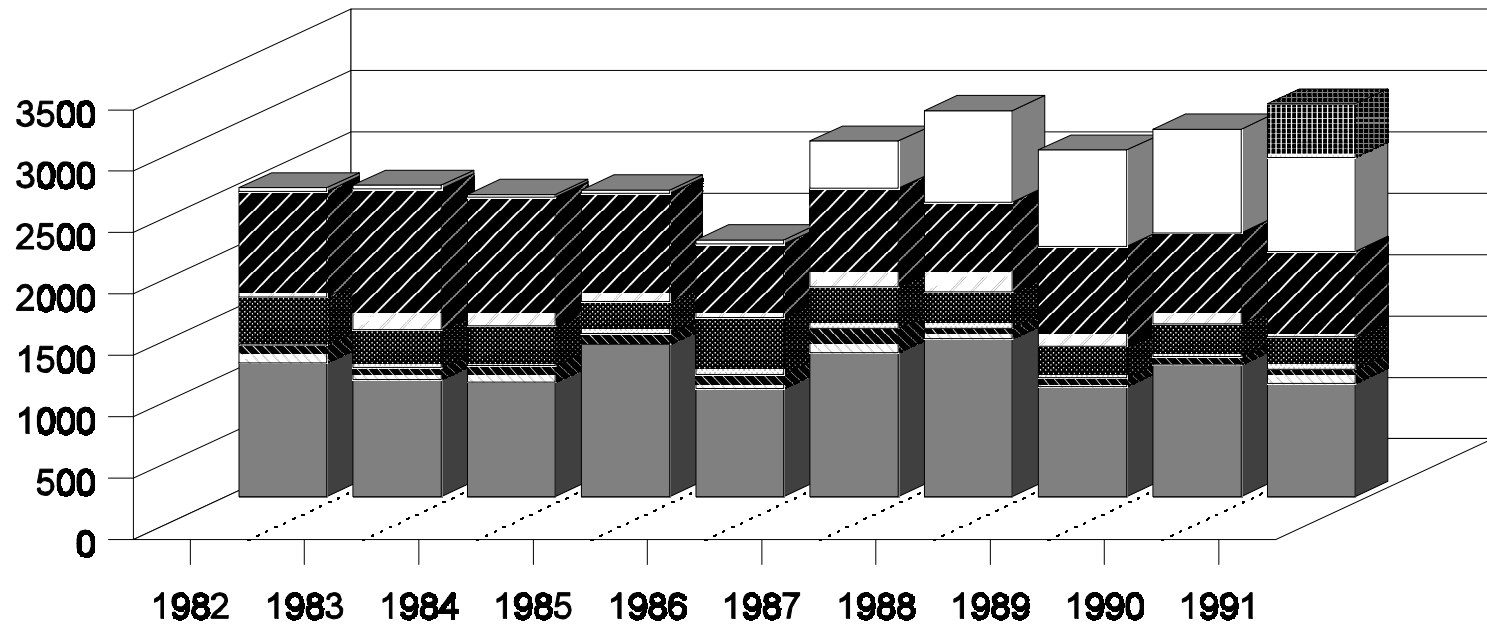


TABLE 1
Summary of Illness/Injury Associated with Suspected Pesticide Exposure
Apart From Those Related to the Cantara Spill
Reported by California Physicians
1991

Type of Illness	Adequate or Complete Data											Incomplete Data	
	Occupational					Non-Occupational					All Un-related	Insufficient	Unavailable
	Def ¹	Pro ²	Pos ³	Unl ⁴	Ind ⁵	Def ¹	Pro ²	Pos ³	Unl ⁴	Ind ⁵			
Systemic	134	325	390	59	1	20	60	40	6	0	126	44	42
Eye	362	77	68	33	0	1	2	1	0	0	154	24	24
Skin	52	56	174	75	2	0	0	5	1	0	153	24	25
Eye/Skin	13	5	19	6	0	0	0	0	0	0	12	1	4
None/ND*	0	0	0	0	0	0	0	0	0	0	54	22	45
Subtotal	561	463	651	173	3	21	62	46	7	0	499	115	140
Total	1851					136					499	255	

* Not Determined; a relationship and/or illness type could not be determined from the information available

¹ Def = Definitely related to pesticide exposure

² Pro = Probably related to pesticide exposure

³ Pos = Possibly related to pesticide exposure

⁴ Unl = Unlikely to be related to pesticide exposure

⁵ Ind = Indirectly related to pesticide exposure

TABLE 2*
Illnesses and Injuries Associated with Exposure to Pesticides
Apart From Those Related to the Cantara Spill
Reported by Physicians in California
Summarized by Activity and Type of Illness/Injury
1991

ACTIVITY	ILLNESS/INJURY TYPE								Total	
	Systemic		Eye		Skin		Eye/Skin			
	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos
Mixer/Loader, Aerial	5	1	2	0	2	0	0	0	9	1
Mixer/Loader, Ground	2	1	10	0	4	1	0	0	16	2
Mixer/Loader, Hand	26	6	104	1	15	2	3	1	148	10
Mixer/Loader, Unknown	0	0	0	0	0	0	0	0	0	0
Applicator, Aerial	1	1	0	0	0	0	0	0	1	1
Applicator, Ground	9	23	8	3	6	11	2	0	25	37
Applicator, Hand	23	45	76	10	12	25	6	2	117	82
Applicator, Other	72	18	134	8	44	24	3	2	253	52
Fumigation, Chamber	1	4	0	0	0	1	0	0	1	5
Fumigation, Field	1	4	0	1	3	3	1	0	5	8
Fumigation, Tarpaulin	2	1	0	0	0	0	0	0	2	1
Flagger	1	2	0	0	0	2	0	0	1	4
Exposed to Drift	142	130	28	10	2	2	1	1	173	143
Repair/Maintenance	10	4	14	3	2	6	0	0	26	13

* Continued on the next page

TABLE 2 (Continued)
Illnesses and Injuries Associated with Exposure to Pesticides
Apart From Those Related to the Cantara Spill
Reported by Physicians in California
Summarized by Activity and Type of Illness/Injury
1991

ACTIVITY	ILLNESS/INJURY TYPE								Total	
	Systemic		Eye		Skin		Eye/Skin			
	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos
Pack/Process (Commodity)	17	9	8	4	2	7	0	1	27	21
Exposed to Field Residue	16	37	5	13	2	64	0	8	23	122
Structural Residue	77	58	1	1	0	5	0	0	78	64
Other Residue	3	8	2	7	4	13	0	2	9	30
Manufacture/Formulation	0	1	1	0	0	1	0	0	1	2
Exposed to Concentrate	17	8	12	2	3	5	0	0	32	15
Emergency Response	10	7	0	0	0	0	0	0	10	7
Other	24	22	34	5	7	2	2	2	67	31
Non-Occupational - less fully reported than occupational cases										
Application	3	2	1	0	0	0	0	0	4	2
Exposed to Drift	21	19	2	1	0	4	0	0	23	24
Exposed to Residue	49	16	0	0	0	1	0	0	49	17
Other	7	3	0	0	0	0	0	0	7	3
TOTALS	539	430	442	69	108	179	18	19	1107	697

TABLE 3A*
Hospitalization and Disability Associated with
Illnesses/Injuries Probably or Definitely Related to Pesticide Exposure
Apart From Those Related to the Cantara Spill
1991

ACTIVITY	TOTAL CASES	HOSPITALIZATION				DISABILITY			
		Number of Cases			Total Days Re- ported	Number of Cases			Total Days Re- ported
		Unk ¹	Indef ²	Rep ³		Unk ¹	Indef ²	Rep ³	
Mixer/Loader, Aerial	9	0	0	1	7	3	0	1	3
Mixer/Loader, Ground	16	0	0	1	2	0	0	4	23
Mixer/Loader, Hand	148	0	0	3	4	4	0	28	83
Applicator, Aerial	1	0	0	0	0	0	0	0	0
Applicator, Ground	25	0	0	2	6	0	0	10	56
Applicator, Hand	117	0	0	0	0	2	0	27	84
Applicator, Other	253	0	0	1	1	9	1	45	137
Fumigation, Chamber	1	0	0	0	0	0	0	1	1
Fumigation, Field	5	0	0	0	0	0	0	1	4
Fumigation, Tarpaulin	2	0	0	0	0	1	0	0	0
Flagger	1	0	0	0	0	0	0	1	16
Exposed to Drift	173	1	0	1	11	6	3	59	397

¹ Unknown whether or not hospitalization/disability occurred.

² Duration of hospitalization/disability not reported.

³ Duration of hospitalization/disability reported as one or more days.

Continued on the next page

TABLE 3A (Continued)
Hospitalization and Disability Associated with
Illnesses/Injuries Probably or Definitely Related to Pesticide Exposure
Apart From Those Related to the Cantara Spill
1991

ACTIVITY	TOTAL CASES	HOSPITALIZATION				DISABILITY			
		Number of Cases			Total Days Re- ported	Number of Cases			Total Days Re- ported
		Unk ¹	Indef ²	Rep ³		Unk ¹	Indef ²	Rep ³	
Repair/Maintenance	26	0	0	1	1	1	0	6	28
Pack/Process (Commodity)	27	0	0	0	0	0	0	5	12
Exposed to Field Residue	23	0	0	0	0	0	0	10	49
Structural Residue	78	0	0	0	0	4	0	32	72
Other Residue	9	0	0	0	0	0	0	3	5
Manufacture/Formulation	1	0	0	0	0	0	0	0	0
Exposed to Concentrate	32	0	0	0	0	0	0	5	11
Emergency Response	10	0	0	0	0	1	0	0	0
Other	67	0	0	1	2	2	0	15	22
Non-Occupational - less fully reported than occupational cases									
Application	4	0	0	0	0	2	0	0	0
Exposed to Drift	23	0	0	1	1	0	0	0	0
Exposed to Residue	49	2	0	2	4	3	0	5	22
Other	7	2	0	1	1	1	0	0	0
Total Probable and Definite Cases	1107	5	0	15	40	39	4	258	1025

¹ Unknown whether or not hospitalization/disability occurred.

² Duration of hospitalization/disability not reported.

³ Duration of hospitalization/disability reported as one or more days.

TABLE 3B*
Hospitalization and Disability Associated with
Illnesses/Injuries Probably or Definitely Related to Pesticide Exposure
Apart From Those Related to the Cantara Spill
1991

ACTIVITY	TOTAL CASES	HOSPITALIZATION				DISABILITY			
		Number of Cases			Total Days Reported	Number of Cases			Total Days Re- ported
		Unk ¹	Indef	Rep ³		Unk ¹	Indef	Rep ³	
Mixer/Loader, Aerial	1	0	0	0	0	0	0	0	0
Mixer/Loader, Ground	2	0	0	0	0	0	0	0	0
Mixer/Loader, Hand	10	0	0	0	0	1	0	2	6
Applicator, Aerial	1	0	0	0	0	0	0	0	0
Applicator, Ground	37	0	0	0	0	1	0	14	34
Applicator, Hand	82	0	0	0	0	5	0	16	55
Applicator, Other	52	0	0	0	0	5	0	14	62
Fumigation, Chamber	5	0	0	0	0	0	0	2	3
Fumigation, Field	8	0	0	0	0	0	0	2	6
Fumigation, Tarpaulin	1	0	0	0	0	0	0	0	0
Flagger	4	0	0	1	3	2	0	0	0
Exposed to Drift	143	0	0	0	0	5	0	35	151

¹ Unknown whether or not hospitalization/disability occurred.

² Duration of hospitalization/disability not reported.

³ Duration of hospitalization/disability reported as one or more days.

***Continued on the next page**

TABLE 3B (Continued)
Hospitalization and Disability Associated with
Illnesses/Injuries Probably or Definitely Related to Pesticide Exposure
Apart From Those Related to the Cantara Spill
1991

ACTIVITY	TOTAL CASES	HOSPITALIZATION				DISABILITY			
		Number of Cases			Total Days Re- ported	Number of Cases			Total Days Re- ported
		Unk ¹	Indef ²	Rep ³		Unk ¹	Indef ²	Rep ³	
Repair/Maintenance	13	0	0	0	0	0	0	3	25
Pack/Process (Commodity)	21	0	0	0	0	2	0	1	5
Exposed to Field Residue	122	1	0	0	0	14	0	27	100
Structural Residue	64	0	0	1	4	1	0	26	108
Other Residue	30	0	0	1	6	1	0	10	221
Manufacture/Formulation	2	0	0	0	0	1	0	1	3
Exposed to Concentrate	15	0	0	0	0	3	0	3	8
Emergency Response	7	0	0	0	0	0	0	1	2
Other	31	0	0	0	0	3	0	8	11
Non-Occupational - less fully reported than occupational cases									
Application	2	0	0	0	0	0	0	0	0
Exposed to Drift	24	0	0	0	0	3	0	0	0
Exposed to Residue	17	0	0	0	0	3	0	0	0
Other	3	0	0	0	0	1	0	0	0
Total Probable and Definite Cases	697	1	0	3	13	51	0	165	800

¹ Unknown whether or not hospitalization/disability occurred.

² Duration of hospitalization/disability not reported.

³ Duration of hospitalization/disability reported as one or more days.

TABLE 4
Illnesses/Injuries Reported in 1991
With Confirmed Relationship to Pesticide Exposure
Apart From those Related to the Cantara Spill
Summarized by Pesticide(s), Type of Illness and Degree of Relationship

PESTICIDE	SYSTEMIC		EYE		SKIN		EYE & SKIN		TOTAL	
	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos
1-NAPHTHALENEACETIC ACID	7	0	0	0	0	1	0	0	7	1
2,4-D	0	0	0	0	0	1	0	0	0	1
ABAMECTIN	0	2	0	0	0	1	0	0	0	3
ACEPHATE	4	4	0	0	0	0	0	0	4	4
ADJUVANT	0	0	2	0	0	0	0	0	2	0
ALLETHRIN	1	0	1	0	0	0	0	0	2	0
ALUMINUM PHOSPHIDE	5	3	1	0	0	0	0	0	6	3
ANILAZINE	0	0	0	0	0	1	0	0	0	1
AZINPHOS-METHYL	0	3	0	0	0	1	0	0	0	4
BENDIOCARB	2	1	1	0	0	1	0	0	3	2
BENOMYL	0	0	1	0	2	1	0	0	3	1
BORIC ACID	3	0	0	0	0	0	0	0	3	0
CALCIUM HYDROXIDE	0	0	0	0	0	1	0	0	0	1
CALCIUM HYPOCHLORITE	6	2	5	0	0	1	0	0	11	3
CAPSAICIN	0	0	2	0	1	0	1	0	4	0
CARBARYL	0	0	1	0	0	0	0	0	1	0
CARBOFURAN	1	0	0	0	0	0	0	0	1	0
CCA	0	0	0	0	1	0	0	0	1	0
CHLORINE	50	12	13	2	2	2	0	0	65	16
CHLORINE DIOXIDE	2	0	0	1	0	0	0	0	2	1
CHLOROTHALONIL	0	1	1	1	1	1	0	0	2	3
CHLORPROPHAM	1	0	0	0	0	0	0	0	1	0

PESTICIDE	SYSTEMIC		EYE		SKIN		EYE & SKIN		TOTAL	
	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos
CHLORPYRIFOS	11	20	3	1	0	2	0	1	14	24
CHLORTHAL DIMETHYL	0	0	0	0	0	1	0	0	0	1
COPPER	1	0	1	0	0	1	0	0	2	1
COPPER 8-QUINOLINOLATE	0	0	0	0	0	1	0	0	0	1
COPPER HYDROXIDE	0	2	0	1	0	0	0	1	0	4
COPPER NAPHTHENATE	0	0	1	0	0	1	0	0	1	1
COPPER SULFATE	0	0	5	0	0	0	0	0	5	0
COUMAPHOS	0	0	0	1	0	0	0	0	0	1
CREOSOTE	0	0	1	3	0	2	0	0	1	5
CYANURIC ACID	6	6	12	0	4	2	0	0	22	8
CYFLUTHRIN	0	4	0	0	0	0	0	1	0	5
CYPERMETHRIN	0	0	0	0	0	1	0	0	0	1
DDVP	0	1	0	0	0	0	0	0	0	1
DEET	0	0	0	0	0	1	0	0	0	1
DEF	1	0	0	0	0	0	0	0	1	0
DIAZINON	6	11	3	1	1	2	0	1	10	15
DIBROMOCHLOROPROPANE	0	2	0	0	0	0	0	0	0	2
DICOFOL	0	1	0	1	0	0	0	0	0	2
DIESEL OIL	0	1	0	0	0	0	0	0	0	1
DIETHATYL ETHYL	0	0	0	0	1	0	0	0	1	0
DIFLUBENZURON	0	0	1	0	0	0	0	0	1	0
DIMETHOATE	7	4	0	0	0	0	0	0	7	4
DINOSEB	1	0	0	0	0	0	0	0	1	0
DIPHACINONE	0	0	0	1	0	0	0	0	0	1
DIQUAT	0	0	1	0	2	0	0	0	3	0
DISODIUM OCTABORATE 4H2O	0	1	0	0	0	0	0	0	0	1
DISULFOTON	1	1	0	0	0	0	0	0	1	1

PESTICIDE	SYSTEMIC		EYE		SKIN		EYE & SKIN		TOTAL	
	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos
DIURON	0	1	0	0	0	0	0	0	0	1
ENDOSULFAN	0	1	0	0	0	1	0	0	0	2
ESFENVALERATE	0	1	0	0	0	1	0	0	0	2
ETHEPHON	1	0	0	1	1	0	0	0	2	1
ETHION	0	1	0	0	0	0	0	0	0	1
ETHYLENE OXIDE	0	2	0	0	0	0	0	0	0	2
FENAMIPHOS	0	2	0	0	0	0	0	0	0	2
FENARIMOL	1	1	0	0	0	0	0	0	1	1
FENBUTATIN-OXIDE	0	0	0	0	0	1	0	0	0	1
FENVALERATE	2	3	0	1	0	0	0	0	2	4
FLUAZIFOP-BUTYL	0	0	0	0	0	2	0	0	0	2
FORMALDEHYDE	4	3	3	0	0	0	0	0	7	3
GIBBERELIC ACID	0	1	0	0	0	0	0	0	0	1
GLUTERALDEHYDE	3	2	23	0	3	1	1	0	30	3
GLYPHOSATE	5	11	21	7	8	8	2	1	36	27
HYDROGEN CHLORIDE	5	0	1	1	3	0	0	0	9	1
IODINE-COMPLEX	0	0	1	0	0	0	0	0	1	0
IPRODIONE	0	1	1	0	0	1	0	1	1	3
ISOCYANURIC ACID	0	0	0	0	0	1	0	0	0	1
K SALTS OF FATTY ACIDS	0	1	0	0	0	0	0	0	0	1
KATHON	0	0	1	0	3	0	0	0	4	0
LIME-SULFUR	0	1	1	0	0	0	0	0	1	1
MALATHION	7	8	2	1	0	0	0	0	9	9
MEPIQUAT CHLORIDE	0	0	0	0	0	1	0	1	0	2
METALAXYL	0	0	0	0	0	1	0	0	0	1
METALDEHYDE	0	0	0	0	0	1	0	0	0	1
METAM-SODIUM	2	4	0	1	3	3	0	0	5	8

PESTICIDE	SYSTEMIC		EYE		SKIN		EYE & SKIN		TOTAL	
	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos
METHAMIDOPHOS	1	1	0	0	0	0	0	0	1	1
METHIDATHION	1	1	0	1	0	0	0	0	1	2
METHOMYL	2	2	0	1	0	1	0	0	2	4
METHYL BROMIDE	11	12	0	0	0	1	1	0	12	13
MEVINPHOS	5	3	0	0	0	0	0	1	5	4
MOLINATE	0	3	0	0	0	0	0	0	0	3
NALED	0	4	0	0	0	0	0	0	0	4
NICOTINE	0	0	0	1	0	0	0	0	0	1
OCTHILINONE	0	0	0	0	1	0	0	0	1	0
ORYZALIN	0	1	0	0	0	0	0	0	0	1
OXADIAZON	0	1	0	0	0	0	0	0	0	1
OXAMYL	4	0	2	0	0	0	0	0	6	0
OXYTHIOQUINOX	0	0	1	0	0	0	0	0	1	0
PACLOBUTRAZOL	0	0	1	0	0	0	0	0	1	0
PARAQUAT	0	3	0	1	1	0	0	0	1	4
PARATHION	3	5	1	0	0	0	0	0	4	5
PENDIMETHALIN	0	1	0	0	0	0	0	0	0	1
PENTACHLOROPHENOL	0	1	0	0	0	0	0	0	0	1
PERMETHRIN	1	0	0	0	0	0	1	0	2	0
PETROLEUM HYDROCARBONS	0	0	0	0	1	0	0	0	1	0
PETROLEUM OIL	0	0	1	0	0	0	0	0	1	0
PHENOLIC DISINFECTANTS	1	0	16	0	7	3	0	0	24	3
PHENOTHHRIN	1	0	0	0	0	0	0	0	1	0
PHORATE	0	1	0	0	0	0	0	0	0	1
PHOSMET	1	1	0	0	0	0	0	0	1	1
PINE OIL	1	2	9	0	0	0	2	0	12	2
PROMETON	0	1	1	0	1	0	0	0	2	1

PESTICIDE	SYSTEMIC		EYE		SKIN		EYE & SKIN		TOTAL	
	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos
PROPARGITE	0	0	2	1	2	1	0	0	4	2
PROPETAMPHOS	12	6	0	0	0	1	0	0	12	7
PROPICONAZOLE	0	0	1	0	0	0	0	0	1	0
PROPOXUR	41	8	0	0	0	0	0	0	41	8
PYRETHRINS	0	2	0	0	0	0	0	0	0	2
PYRETHRINS/PIPERONYL BUTO	3	4	7	1	0	2	0	0	10	7
QUATERNARY AMMONIA	4	4	49	1	19	4	0	0	72	9
RESMETHRIN	2	1	1	0	0	0	0	0	3	1
SIMAZINE	0	0	1	0	0	0	0	0	1	0
SODIUM CHLORITE	0	0	1	0	0	0	0	0	1	0
SODIUM HYDROXIDE	0	0	1	0	0	0	0	0	1	0
SODIUM HYPOCHLORITE	92	20	150	9	18	11	4	2	264	42
SULFOMETURON METHYL	0	0	0	0	0	1	0	0	0	1
SULFUR	2	10	7	6	2	17	0	1	11	34
SULFUR DIOXIDE	6	3	0	1	0	3	0	0	6	7
SULFURYL FLUORIDE	1	0	0	0	0	0	0	0	1	0
THIOPHANATE-METHYL	0	0	0	2	0	1	1	0	1	3
TRICLOPYR	0	0	1	0	0	0	0	0	1	0
TRIFLURALIN	0	0	0	0	0	1	0	0	0	1
TRIFORINE	0	1	0	0	0	0	0	0	0	1
ZIRAM	1	0	0	0	0	1	0	0	1	1
COMBINATIONS OF CHOLINESTERASE-INHIBITING INSECTICIDES	7	8	1	1	0	2	0	0	8	11
COMBINATIONS OF INSECTICIDES OTHER THAN CHOLINESTERASE INHIBITORS	8	12	2	0	0	4	0	1	10	17
COMBINATIONS OF INSECTICIDES INCLUDING BOTH CHOLINESTERASE INHIBITOR(S) AND OTHER(S)	66	107	3	2	1	7	1	0	71	116
COMBINATIONS OF HERBICIDES/DEFOLIANTS	10	10	7	1	1	6	0	0	18	17

PESTICIDE	SYSTEMIC		EYE		SKIN		EYE & SKIN		TOTAL	
	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos	Def/ Prob	Pos
COMBINATIONS OF HERBICIDE(S)/DEFOLIANT(S) WITH CHOLINESTERASE-INHIBITING INSECTICIDES(S)	4	1	0	1	0	0	0	0	4	2
COMBINATIONS OF FUNGICIDES	0	3	0	1	1	10	0	3	1	17
COMBINATIONS OF FUNGICIDE(S) WITH CHOLINESTERASE-INHIBITING INSECTICIDE(S)	5	6	3	0	1	6	0	1	9	13
COMBINATIONS OF FUNGICIDE(S) WITH INSECTICIDE(S) OTHER THAN CHOLINESTERASE INHIBITORS	1	2	2	0	0	10	1	0	4	12
COMBINATIONS OF FUNGICIDE(S) WITH BOTH CHOLINESTERASE-INHIBITING AND OTHER INSECTICIDES	2	7	1	2	0	8	1	1	4	18
COMBINATIONS OF FUMIGANT(S) WITH INSECTICIDE(S) OTHER THAN CHOLINESTERASE INHIBITORS	16	5	0	0	1	0	0	0	17	5
COMBINATIONS OF ANTIMICROBIALS	42	9	44	1	11	11	0	1	97	22
COMBINATIONS OF ANTIMICROBIAL(S) WITH FUNGICIDE(S)	0	0	0	0	0	1	0	0	0	1
COMBINATIONS OF CHOLINESTERASE-INHIBITING INSECTICIDE(S) WITH AN INSECT GROWTH REGULATOR	23	8	1	0	0	0	0	0	24	8
MISCELLANEOUS COMBINATIONS	0	9	2	4	0	8	0	0	2	21
UNKNOWN PESTICIDES	13	15	13	6	4	10	2	1	32	32
TOTAL	539	430	442	69	108	179	18	19	1107	697

TABLE 5
Summary of Illness/Injury Incidents
Apart From Those Related to the Cantara Spill
Reported by Physicians According to County of Occurrence*

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate ¹	Pesticide Use ²	Pesticide Residue ³	Agric.	Non- Agric.
ALAMEDA						
Definite	19	1	16	0	0	19
Probable	9	0	8	1	0	9
Possible	11	0	6	3	1	10
Unlikely	2	0	0	0	0	2
Asymptomatic	2	0	2	0	0	2
Unrelated	5	1	2	1	0	5
Insufficient	1					
BUTTE						
Definite	2	0	1	1	0	2
Probable	5	2	1	0	0	5
Possible	6	1	4	0	3	3
Unlikely	4	0	3	1	3	1
Asymptomatic	2	2	0	0	0	2
Unrelated	1	0	0	0	0	1
CALAVERAS						
Probable	2	0	2	0	0	2
Insufficient	1					
COLUSA						
Probable	2	0	1	1	1	1
Possible	4	0	2	1	3	1
Asymptomatic	1	0	1	0	1	0
Unrelated	7	0	0	7	7	0

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COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate ¹	Pesticide Use ²	Pesticide Residue ³	Agric.	Non- Agric.
CONTRA COSTA						
Definite	11	1	8	1	0	11
Probable	7	1	4	2	0	7
Possible	5	1	2	1	1	4
Unlikely	4	0	1	3	0	4
Unrelated	7	0	3	2	0	6
Insufficient	1					
Unavailable	1					
DEL NORTE						
Definite	3	1	2	0	0	3
Probable	1	0	1	0	0	1
Possible	1	0	0	1	0	1
Unrelated	1	0	1	0	0	1
EL DORADO						
Definite	3	0	3	0	0	3
Probable	1	0	1	0	0	1
Possible	5	0	3	2	0	5
Unrelated	1	0	1	0	0	1
FRESNO						
Definite	31	1	27	2	16	15
Probable	23	2	14	4	9	14
Possible	45	2	20	21	31	14
Unlikely	12	1	4	7	10	2
Asymptomatic	3	0	3	0	3	0
Unrelated	29	4	10	14	12	17
Insufficient	3					
Unavailable	38					

TABLE 5
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COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate ¹	Pesticide Use ²	Pesticide Residue ³	Agric.	Non- Agric.
GLENN						
Definite	2	0	1	1	2	0
Unrelated	1	0	0	1	1	0
HUMBOLDT						
Definite	6	0	6	0	0	6
Probable	1	0	1	0	1	0
Possible	2	0	1	1	1	1
Unlikely	3	0	1	2	3	0
Unrelated	3	0	1	1	1	2
Insufficient	1					
Unavailable	1					
IMPERIAL						
Definite	5	0	5	0	4	1
Probable	1	0	1	0	1	0
Possible	8	0	1	6	8	0
Asymptomatic	2	0	2	0	2	0
Unrelated	2	0	1	1	1	0
KERN						
Definite	20	0	18	1	8	12
Probable	21	0	13	7	12	9
Possible	38	0	10	27	35	3
Unlikely	31	0	1	30	29	1
Unrelated	30	0	8	16	24	6
Insufficient	7					
Unavailable	3					

TABLE 5
Summary of Illness/Injury Incidents
Apart From Those Related to the Cantara Spill
Reported by Physicians According to County of Occurrence*

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate ¹	Pesticide Use ²	Pesticide Residue ³	Agric.	Non- Agric.
KINGS						
Definite	5	0	3	2	2	3
Probable	2	0	0	1	2	0
Possible	5	0	4	0	4	1
Unlikely	1	0	0	0	1	0
Unrelated	11	0	6	3	11	0
Unavailable	2					
LAKE						
Definite	1	0	1	0	0	1
Possible	1	0	0	1	0	1
Insufficient	1					
LASSEN						
Definite	1	0	1	0	0	1
Insufficient	1					
LOS ANGELES						
Definite	90	2	62	3	0	90
Probable	138	8	50	39	0	138
Possible	64	4	29	21	5	59
Unlikely	10	0	2	6	0	10
Asymptomatic	3	2	1	0	0	3
Unrelated	76	7	41	15	4	71
Insufficient	22					
Unavailable	24					

TABLE 5
Summary of Illness/Injury Incidents
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COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate ¹	Pesticide Use ²	Pesticide Residue ³	Agric.	Non- Agric.
MADERA						
Definite	6	0	4	0	2	4
Probable	5	0	4	1	5	0
Possible	10	0	3	6	7	3
Unlikely	2	0	1	1	2	0
Unrelated	5	0	0	5	4	1
Unavailable	1					
MARIN						
Definite	3	0	3	0	0	3
Possible	2	1	1	0	0	2
Unrelated	2	0	2	0	0	2
Unavailable	1					
MARIPOSA						
Definite	2	0	2	0	0	2
Possible	1	0	1	0	0	1
MENDOCINO						
Definite	6	0	4	1	0	6
Possible	3	0	1	2	2	1
Unrelated	1	0	1	0	0	1
Insufficient	1					
MERCED						
Definite	6	0	3	0	0	5
Probable	11	0	6	5	8	3
Possible	15	0	6	9	10	5
Unlikely	4	0	3	1	4	0
Indirect	1	0	0	1	1	0
Asymptomatic	2	0	0	0	1	1
Unrelated	9	0	5	3	7	2

TABLE 5
Summary of Illness/Injury Incidents
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COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate ¹	Pesticide Use ²	Pesticide Residue ³	Agric.	Non- Agric.
MONTEREY						
Definite	14	0	9	2	10	4
Probable	28	0	12	5	28	0
Possible	124	3	88	26	97	27
Unlikely	13	0	3	9	13	0
Asymptomatic	5	0	0	2	5	0
Unrelated	19	1	9	8	13	6
Insufficient	1					
Unavailable	5					
NAPA						
Definite	7	0	7	0	2	5
Probable	3	0	3	0	1	2
Possible	6	0	2	4	5	1
Unlikely	3	0	0	2	2	1
Unrelated	6	0	4	1	3	3
NEVADA						
Definite	3	0	3	0	0	3
Probable	1	0	1	0	0	1
ORANGE						
Definite	24	0	21	0	2	22
Probable	35	1	29	3	0	35
Possible	31	0	20	9	3	28
Unlikely	4	0	3	1	0	4
Asymptomatic	2	0	2	0	0	2
Unrelated	18	0	8	5	3	15
Insufficient	5					
Unavailable	8					

TABLE 5
Summary of Illness/Injury Incidents
Apart From Those Related to the Cantara Spill
Reported by Physicians According to County of Occurrence*

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate ¹	Pesticide Use ²	Pesticide Residue ³	Agric.	Non- Agric.
PLACER						
Definite	9	0	2	7	0	9
Probable	1	0	1	0	0	1
Possible	3	0	2	1	1	2
Unlikely	1	0	1	0	0	1
Unrelated	12	0	4	0	2	10
Unavailable	1					
PLUMAS						
Definite	1	0	1	0	0	1
Unlikely	1	0	0	1	0	1
RIVERSIDE						
Definite	21	1	17	1	10	11
Probable	11	3	5	0	0	11
Possible	37	0	17	19	23	14
Unlikely	14	0	5	9	13	1
Unrelated	10	0	5	4	6	4
Insufficient	7					
Unavailable	4					
SACRAMENTO						
Definite	22	1	16	4	0	22
Probable	15	2	10	3	1	14
Possible	11	0	5	2	3	8
Unlikely	2	0	1	1	0	2
Unrelated	17	1	10	4	0	17
Insufficient	6					
Unavailable	13					

TABLE 5
Summary of Illness/Injury Incidents
Apart From Those Related to the Cantara Spill
Reported by Physicians According to County of Occurrence*

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate ¹	Pesticide Use ²	Pesticide Residue ³	Agric.	Non- Agric.
SAN BENITO						
Definite	4	0	3	0	4	0
Probable	1	0	1	0	0	1
Possible	1	0	0	0	1	0
Unlikely	2	0	0	2	1	1
Unrelated	2	0	1	1	2	0
Insufficient	1					
SAN BERNARDINO						
Definite	23	2	20	1	0	23
Probable	12	1	8	3	0	12
Possible	19	4	7	3	0	19
Asymptomatic	1	0	0	1	0	1
Unrelated	9	0	6	0	0	9
Insufficient	1					
Unavailable	1					
SAN DIEGO						
Definite	53	1	49	0	1	52
Probable	26	0	12	7	0	26
Possible	28	1	18	4	7	21
Unlikely	6	0	5	1	1	5
Indirect	1	0	1	0	1	0
Asymptomatic	1	0	0	0	0	1
Unrelated	48	0	15	23	3	44
Insufficient	15					
Unavailable	5					

TABLE 5
Summary of Illness/Injury Incidents
Apart From Those Related to the Cantara Spill
Reported by Physicians According to County of Occurrence*

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate ¹	Pesticide Use ²	Pesticide Residue ³	Agric.	Non- Agric.
SAN FRANCISCO						
Definite	12	0	10	1	0	12
Probable	14	1	12	1	0	14
Possible	11	1	4	6	0	11
Unrelated	1	0	1	0	0	1
Insufficient	10					
Unavailable	1					
SAN JOAQUIN						
Definite	21	0	14	6	2	19
Probable	17	0	14	2	4	13
Possible	19	0	7	9	8	11
Unlikely	3	0	1	1	1	2
Asymptomatic	1	0	0	0	1	0
Unrelated	22	0	16	2	10	12
Insufficient	3					
Unavailable	7					
SAN LUIS OBISPO						
Definite	5	0	4	0	2	3
Probable	7	0	7	0	0	7
Possible	5	0	2	3	3	2
Unlikely	5	0	3	2	2	3
Asymptomatic	1	0	1	0	0	1
Unrelated	5	0	5	0	0	5

TABLE 5
Summary of Illness/Injury Incidents
Apart From Those Related to the Cantara Spill
Reported by Physicians According to County of Occurrence*

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate ¹	Pesticide Use ²	Pesticide Residue ³	Agric.	Non- Agric.
SAN MATEO						
Definite	6	0	4	2	0	6
Probable	4	0	2	2	1	3
Possible	15	1	3	11	8	7
Unlikely	4	0	1	3	1	3
Unrelated	9	1	4	4	5	4
Insufficient	2					
SANTA BARBARA						
Definite	6	0	6	0	2	4
Probable	44	0	40	1	44	0
Possible	17	0	7	8	10	7
Unlikely	5	0	3	2	4	1
Unrelated	10	2	3	2	5	5
Insufficient	1					
Unavailable	1					
SANTA CLARA						
Definite	27	1	19	1	2	25
Probable	10	2	6	2	0	10
Possible	31	3	17	6	1	30
Unlikely	7	0	2	3	3	4
Unrelated	17	0	11	4	2	15
Insufficient	6					
Unavailable	3					

TABLE 5
Summary of Illness/Injury Incidents
Apart From Those Related to the Cantara Spill
Reported by Physicians According to County of Occurrence*

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate ¹	Pesticide Use ²	Pesticide Residue ³	Agric.	Non- Agric.
SANTA CRUZ						
Definite	9	0	6	1	1	8
Probable	12	0	3	9	3	9
Possible	8	0	5	2	5	3
Unlikely	5	0	3	1	5	0
Unrelated	2	0	2	0	0	2
Unavailable	1					
SHASTA						
Definite	6	0	2	4	0	6
Probable	2	0	0	2	0	2
Possible	3	0	2	1	0	3
Unrelated	3	0	2	1	1	2
Unavailable	1					
SISKIYOU						
Definite	11	0	5	1	0	11
Probable	2	0	0	0	0	2
Possible	10	0	0	1	1	9
Unlikely	1	0	0	1	0	1
Unrelated	1	0	1	0	0	1
Unavailable	3					
SOLANO						
Definite	6	1	4	0	1	5
Probable	9	1	7	1	2	7
Possible	8	0	4	3	4	4
Unlikely	1	0	0	1	0	1
Unrelated	6	2	2	1	0	6

TABLE 5
Summary of Illness/Injury Incidents
Apart From Those Related to the Cantara Spill
Reported by Physicians According to County of Occurrence*

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate ¹	Pesticide Use ²	Pesticide Residue ³	Agric.	Non- Agric.
SONOMA						
Definite	7	0	7	0	1	6
Possible	8	0	4	4	4	4
Unlikely	2	0	1	1	1	1
Asymptomatic	1	0	1	0	0	1
Unrelated	5	0	1	3	3	2
Unavailable	2					
STANISLAUS						
Definite	23	3	13	5	7	16
Probable	14	0	11	3	5	9
Possible	8	1	6	0	5	3
Unlikely	10	0	5	5	7	3
Indirect	1	0	1	0	0	1
Unrelated	14	1	6	6	8	6
Insufficient	2					
Unavailable	3					
SUTTER						
Definite	1	0	1	0	0	1
Probable	5	0	1	2	3	2
Possible	2	0	2	0	1	1
Unlikely	3	0	2	0	3	0
Unrelated	4	0	3	0	1	3
Insufficient	1					
Unavailable	2					
TEHAMA						
Definite	3	0	3	0	3	0
Probable	3	0	3	0	0	3
Unrelated	1	0	1	0	0	1

TABLE 5
Summary of Illness/Injury Incidents
Apart From Those Related to the Cantara Spill
Reported by Physicians According to County of Occurrence*

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate ¹	Pesticide Use ²	Pesticide Residue ³	Agric.	Non- Agric.
TRINITY						
Unrelated	1	0	0	0	0	1
TULARE						
Definite	19	0	12	6	15	4
Probable	13	0	11	2	11	2
Possible	31	0	13	14	25	6
Unlikely	9	0	4	5	8	1
Asymptomatic	3	0	2	0	2	1
Unrelated	17	0	8	7	15	1
Insufficient	10					
Unavailable	4					
TUOLUMNE						
Definite	4	0	3	0	0	4
Possible	2	0	1	0	1	1
Unlikely	1	0	0	0	0	1
Unrelated	1	0	0	0	0	1
VENTURA						
Definite	6	0	5	0	3	3
Probable	2	1	1	0	1	1
Possible	21	0	11	10	13	8
Unlikely	3	0	2	1	1	2
Asymptomatic	1	0	1	0	0	1
Unrelated	8	1	4	3	3	5
Insufficient	4					
Unavailable	4					

TABLE 5
Summary of Illness/Injury Incidents
Apart From Those Related to the Cantara Spill
Reported by Physicians According to County of Occurrence*

COUNTY Relationship	TOTAL CASES	Type of Exposure			Type of Use	
		Pesticide Concentrate ¹	Pesticide Use ²	Pesticide Residue ³	Agric.	Non- Agric.
YOLO						
Definite	7	1	6	0	2	5
Probable	5	1	2	0	0	5
Possible	11	1	5	2	5	6
Unlikely	2	0	1	1	1	1
Unrelated	6	0	2	3	5	1
YUBA						
Possible	1	0	0	0	0	1
Unrelated	4	0	3	0	3	1
TOTALS:						
Definite	582	17	442	54	104	477
Probable	525	26	309	109	143	382
Possible	697	24	346	250	345	352
Unlikely	180	1	62	104	119	60
Indirect	3	0	2	1	2	1
Asymptomatic	31	4	16	3	15	16
Unrelated	469	21	219	151	165	299
Overall	2487	93	1396	672	893	1587
Insufficient	114					
Unavailable	140					

* Type of exposure determined by activity at time of exposure

1 Exposure to concentrate includes exposure incurred in the process of manufacture, formulation, response to emergencies, or while handling pesticide containers in the course of shipping, warehousing or retailing.

2 Exposure via pesticide use includes exposures to mixers, loaders, applicators, flaggers, fumigators, and people exposed to drift.

3 Exposure to pesticide residues in the field, on commodities being packed or processed, on equipment being serviced, resulting from structural applications, or any other residue encountered in the course of employment.

TABLE 6
Number of Cases Classified as Systemic
Apart from Those Related to the Cantara Spill
by Types of Symptoms Reported and Degree of Relationship
- 1991 -

Symptomatology Reported	Probability of Relationship			Total
	Definite	Probable	Possible	
Respiratory & Other Systemic				
including topical (eye and/or skin)	27	52	49	128
without topical effects	26	100	83	209
Systemic but not Respiratory				
including topical effects	18	28	47	93
without topical effects	26	79	149	254
Respiratory Effects				
including topical effects	23	60	44	127
without topical effects	34	66	58	158

TABLE 7
Pesticide-Associated Skin Disease
Among Field Workers
1982 - 1991

Year	Definite or Probable	Possible
1982	32	105
1983	28	77
1984	45	99
1985	154	146
1986	148	56
1987	51	139*
1988	62	186
1989	7	77
1990	8	98
1991	2	64

* Evaluation of field worker dermatitis became more conservative in 1987, following a 1986 study that demonstrated the difficulty of collecting reliable information.

TABLE 8

**Age Distribution of Cases Definitely, Probably or Possibly
Related to Exposure to Pesticides
Other than Antimicrobial**

Age Group	Agricultural			Non-Agricultural		
	Male	Female	Unknown	Male	Female	Unknown
Age Unknown	5	1	0	10	22	0
< 10 years	1	2	0	9	5	0
10 - 14.9	2	0	0	2	3	1
15 - 19.9	22	1	0	11	6	0
20 - 29.9	154	43	0	96	47	0
30 - 39.9	111	54	0	84	57	0
40 - 49.9	58	33	0	33	55	0
50 - 59.9	27	9	0	19	24	0
60 + years	11	4	0	9	7	0
Total	391	147	0	273	226	1

**Age Distribution of Cases Definitely, Probably of Possibly
Related to Antimicrobial Exposure**

Age Group	Agricultural			Non-Agricultural		
	Male	Female	Unknown	Male	Female	Unknown
Age Unknown	0	1	0	7	11	0
< 10 years	0	0	0	1	1	0
10 - 14.9	0	0	0	5	9	0
15 - 19.9	4	0	0	37	30	0
20 - 29.9	7	6	0	146	86	0
30 - 39.9	8	7	0	90	81	0
40 - 49.9	7	6	0	67	63	0
50 - 59.9	3	2	0	34	29	0
60 + years	3	0	0	6	9	0
Total	32	22	0	393	319	0

Table 8 (continued)

**Age Distribution of Cases Definitely, Probably or Possibly
Related to Exposure to Metam-Sodium
Subsequent to the Spill at Cantara**

Age Group	Agricultural			Non-Agricultural		
	Male	Female	Unknown	Male	Female	Unknown
Age Unknown	0	0	0	10	8	1
< 10 years	0	0	0	24	33	0
10 - 14.9	0	0	0	14	13	0
15 - 19.9	0	0	0	10	9	0
20 - 29.9	0	0	0	15	34	0
30 - 39.9	0	0	0	42	53	0
40 - 49.9	0	0	0	39	40	0
50 - 59.9	0	0	0	22	19	0
60 + years	0	0	0	21	28	0
Total	0	0	0	197	237	1

TABLE 9

**Classification of Cases
Apart From Those Related to the Cantara Spill
By Symptom Type and Pesticide Type**

Pesticide Type	Eye Symptoms Only					
	Definite	Probable	Possible	Unlikely	Indirect	Unrelated
Antimicrobials	297	41	17	11	0	31
ChE Inhibitors	16	8	13	12	0	3
Other Pesticides	50	30	39	10	0	120
	Skin Symptoms, With or Without Eye Involvement					
Antimicrobials	40	42	42	14	0	13
ChE Inhibitors	2	4	40	24	1	5
Other Pesticides	23	15	116	44	1	147
	Systemic or Respiratory Symptoms With or Without Eye or Skin Involvement					
Antimicrobials	82	142	63	8	0	28
ChE Inhibitors	42	176	230	24	0	11
Other Pesticides	30	67	137	33	1	87

Unclassified Cases		
Pesticide Type	Insufficient	Unavailable
Antimicrobials	33	71
ChE Inhibitors	7	10
Other Pesticides	75	59
Asymptomatic Cases		
Pesticide Type	Classified Asymp- tomatic	Classified Unrelated
Antimicrobials	6	1
ChE Inhibitors	16	1
Other Pesticides	9	21